Progress Report
(task 3)

Project Title: BMPs for Florida blueberries.

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Objective: Determine nutrient concentration and total nutrient loads under typical production of young and mature blueberries (*Vaccinium corymbosum* x *V. ashei*) grown on pine bark beds under sprinkler and micro irrigation systems using several scheduling scenarios.

Background. Southern highbush blueberry acreage and production has rapidly increased in Florida during the last decade (Williamson and Lyrene, 2005). Blueberry acreage has more than doubled in the last 10 years; production has increased from about 1.5 million pounds in 1999 to over 3.5 million pounds in 2003.The estimated value of the Florida blueberry industry increased by over 250% during this same period (Williamson and Lyrene, 2005). As growers seek out more profitable crops, recent observations have seen growers convert existing citrus and strawberry acreage to blueberries. Most of the acreage planted during the last decade is grown under a new production system known as “pine bark culture” (Williamson and Lyrene, 2000; Williamson and Lyrene, 2005). Beds of pine bark ranging from 3 (single row beds) to 8 (double row beds) feet wide and 6 to 8 inches deep are laid out in rows and plants are set directly in the bark rather than in the soil.

Blueberry plants grow rapidly in pine bark but their root systems are restricted to the pine bark layer with very little penetration into the underlying soil. An informal grower survey revealed that Florida blueberry growers irrigated once every 2 to 3 days during the growing season and apply ½ to ¾ inch of water at each irrigation event. Frequent irrigation is needed because pine bark beds dry out rapidly due to their low water holding capacities and because roots are confined to the pine bark layer. We believe that the amounts of water typically applied during each irrigation event are in excess of what is needed to irrigate the effective root zone.

A typical fertilization program for bearing blueberry plants grown in pine bark culture includes 18-06-12 fertilizer with 4.5% of the N in slow release form (coated urea). About 250 pounds of actual N per year is applied, often divided into about 5 or 6 applications beginning in March and ending in October.

Methods:
The experiment is located on a commercial blueberry farm irrigated using an overhead sprinkler system. There are 2 treatments: 1) a standard grower controlled irrigation schedule (every 2 to 3 days with relatively long irrigation events); and 2) a short irrigation event each day. Initially, in the second experiment, irrigation will be based on historical monthly ET_0 and a crop coefficient of 1.00. The irrigation amount will be adjusted based on the amount of deep percolation water collected in the simple drainage lysimeters that have been installed under 4 plants in each treatment.

Simple drainage lysimeters (4 per treatment) were installed at the beginning of 2006 in the grower's field. Mature, dormant, blueberry plants were excavated from pine bark beds with roots intact. The shallow, restricted, root systems in pine bark beds allows for excavation with minimal stress to the plant. Plants should be fully recovered no later than 12 months after transplanting. Lysimeters constructed of large plastic containers cut longitudinally in half and placed side by side were positioned in the pine bark beds and excavated plants were replanted on top of them. Lysimeters are 48 inches long, 44 inches (2 x 22) inches wide, and 11 inches deep. A well screen placed in the bottom of each lysimeters and vacuum tubes and vacuum pump enable extraction and measurement of effluent. The lysimeters will allow for a total water balance for the mature blueberry plants, calculation of actual plant coefficient, and quantification of nutrient leaching from the root zone.

Water quality study. We are collecting deep percolation water from eight lysimeters in Island Grove every month. The sampling started in November 2006 and so far 3 sets of data has been collected according to the EPA procedures submitted to the UF Analytical Laboratory. Based on these water samples the concentration of nutrients (TP, ortho-P, TKN, NH_4-N, NH_3-N,) and the total monthly loads of these nutrients will be estimated for young and mature blueberry plants.

Due to the cut in funding, the water quality study this year is only for mature plants at Island Grove where we are following the typical fertilization program of the collaborating grower. The 18-06-12 fertilizer with 4.5% of the N in slow release form (coated urea) was applied. The total of 250 pounds of actual N divided into about 5 or 6 applications beginning in March and ending in October is applied every year.

The experiment has been established using funding from the SWFWMD. Water quality study has been funded by FDACS.

This report addresses Task 3

Table 1 presents overall water application at the Island Grove in both treatments: grower's field and UF managed field. Table s 2,3 and 4 summarize the water quality results from seven months of the experiment (November 2006 through May 2007). Table 2 shows the average monthly concentrations of nutrients in the deep percolated water (runoff from the lysimeters) for both treatments. Table 3 represents average monthly loads per plant and Table 4 shows these loads per hectare assuming 3,700 plants/ha which is a typical density for blueberry plants.

Table 1.
Water application at UF plot and Grower's plot

month	UF avg. applied irrigation (mm/day)	Grower Avg. applied irrigation (mm/day)	Monthly rain totals (mm)	Monthly UF Irrigation totals (mm)	Monthly Grower Irrigation Totals (mm)	Monthly Cold protection UF (mm)	Monthly Cold protection Grower (mm)
May-06	3.00	6.30	9.7	93.0	195.3	0.0	0.0
June-06	3.00	8.30	122.0	90.0	249.0	0.0	0.0
July-06	1.76	2.44	178.0	54.7	75.6	0.0	0.0
August-06	1.45	2.80	117.0	44.8	86.8	0.0	0.0
September-06	1.59	2.25	74.4	47.6	67.5	0.0	0.0
October-06	1.99	3.10	39.9	61.7	96.1	0.0	0.0
November-06	2.28	0.30	34.0	68.4	9.0	0.0	0.0
December-06	2.04	0.54	40.9	63.1	16.8	0.0	0.0
January-07	4.78	6.02	53.9	148.3	186.7	88.0	134.0
February-07	5.99	8.89	45.0	167.6	249.0	97.0	139.0
March-07	2.98	5.50	30.5	92.3	170.5	0.0	0.0
April-07	6.20	4.13	29.0	185.9	123.9	0.0	0.0
May-07	6.09	4.26	18.5	188.9	132.0	0.0	0.0

Table 2. Island Grove Nutrient Concentration

Month	Runoff (liter)		Nutrient Concentration (ppm)									
	UF	Grower	UF					Grower				
			NH3-N	**NOx-N**	**TKN**	**TotaP**	**OrtoP**	**NH3-N**	**NOx-N**	**TKN**	**TotaP**	**OrtoP**
Nov. 2006	17.35	83.48	0.20	27.30	1.10	1.87	NAI	0.19	11.33	1.53	0.56	NAI
Dec. 2006	15.41	0.75										
Jan. 2007	40.075	88.492	0.39	59.93	1.82		1.79	0.12	7.97	1.92		0.35
Feb. 2007	40.725	172.605	0.75	51.59	2.83	1.47		0.08	16.17	3.06	0.45	
Mar. 2007	14.00	135.95	1.76	36.44				2.23	1.19			
Apr. 2007	19.22	65.85	0.35	42.00	1.34			0.37	9.20	4.85		
May.2007	43.65	83.25	0.18	26.44	1.38			0.14	12.07	5.76		

Table 3. Island Grove Nutrient Load

Month	Runoff (liter)		Nutrient Load (mg/plant)									
	UF	Grower	UF					Grower				
			NH3-N	**NOx-N**	**TKN**	**TotaP**	**OrtoP**	**NH3-N**	**NOx-N**	**TKN**	**TotaP**	**OrtoP**
Nov. 2006	17.35	83.48	3.40	473.61	19.07	32.41	NAI	16.19	946.15	127.53	46.75	NAI
Dec. 2006	15.41	0.75										
Jan. 2007	40.075	88.492	15.77	2401.57	72.88		71.63	10.56	705.06	169.49		31.26
Feb. 2007	40.725	172.605	30.53	2100.87	115.31	59.71		13.33	2790.24	527.37	78.46	
Mar. 2007	14.00	135.95	24.59	510.11				303.58	161.99			
Apr. 2007	19.22	65.85	6.64	807.40	25.82			24.36	605.57	319.45		
May.2007	43.65	83.25	7.72	1154.03	60.20			11.70	1004.63	479.58		

Note: NAI: for Not Analyzed Due to Interference.

There are about 3700 blueberry plants per hectare.

Table 4. Island Grove Nutrient Load per ha

Month	Runoff (m3)		Nutrient Load (g/ha)									
	UF	Grower	UF					Grower				
			NH3-N	**NOx-N**	**TKN**	**TotaP**	**OrtoP**	**NH3-N**	**NOx-N**	**TKN**	**TotaP**	**OrtoP**
Nov. 2006	64.195	308.876	12.58	1752.357	70.559	119.917	NAI	59.903	3500.755	471.861	172.975	NAI
Dec. 2006	57.017	2.775										
Jan. 2007	148.2775	327.4204	58.349	8885.809	269.656		265.031	39.072	2608.722	627.113		115.662
Feb. 2007	150.6825	638.6385	112.961	7773.219	426.647	220.927		49.321	10323.89	1951.269	290.302	
Mar. 2007	51.8	503.015	90.983	1887.407				1123.246	599.363			
Apr. 2007	71.114	243.645	24.568	2987.38	95.534			90.132	2240.609	1181.965		
May.2007	161.505	308.025	28.564	4269.911	222.74			43.29	3717.131	1774.446		

Note: NAI: for Not Analyzed Due to Interference.

There are about 3700 blueberry plants per hectare.

Literature Cited

Williamson, J. G., Lyrene, P. M. 2001. A survey of blueberry acreage in Florida. Florida State Horticultural Society Meetings 113:24 - 25.

Williamson, J.G. and P.M. Lyrene. 2005. The Florida blueberry industry: A decade of growth. Florida State Horticultural Society Meetings. (in press).

Table 4. Tasks, Deliverables and Timeline.

	Task	Report	Date
1	Identify and hire a graduate research assistant		First month after funding
2	Water quality sample collection (every month)		First month after funding
3	Annual data collection and analysis from both sites, including rainfall, water application (supplemental and cold protection), plant water use (ETo and Etc), plant growth, and deep percolation water quality.	The report will include water quality of deep percolation collected in lysimeters and estimated total loads per acre.	A year from the beginning of the water quality project